

(19)

Europäisches Patentamt

European Patent Office

Office européen des brevets



(11)

EP 0 407 615 B2

(12)

NEW EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention
of the opposition decision:

23.06.2004 Bulletin 2004/26

(51) Int Cl.7: B42D 15/10, B41M 5/40

(45) Mention of the grant of the patent:
16.10.1996 Bulletin 1996/42

(86) International application number:
PCT/JP1990/000109

(21) Application number: 90902374.9

(87) International publication number:
WO 1990/008661 (09.08.1990 Gazette 1990/19)

(22) Date of filing: 30.01.1990

(54) THERMAL TRANSFER RECORDING MEDIUM

SPEICHERMEDIUM DURCH WÄRMEÜBERTRAGUNG

SUPPORT D'ENREGISTREMENT PAR TRANSFERT THERMIQUE

(84) Designated Contracting States:
BE CH DE DK ES FR GB IT LI NL SE

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(30) Priority: 31.01.1989 JP 2234689
13.02.1989 JP 3345589
13.02.1989 JP 3345689
20.11.1989 JP 29977489
20.11.1989 JP 29977589
20.11.1989 JP 29977689
27.11.1989 JP 30484589
27.11.1989 JP 30484489

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(43) Date of publication of application:
16.01.1991 Bulletin 1991/03

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(60) Divisional application:
96105487.1 / 0 723 875

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- PATENT ABSTRACTS OF JAPAN vol. 8, no. 207
(M-327)(1644) 21 September 1984, JP-A-59 95195
(MITSUBISHI DENKI K.K.) 01 June 1984,
- Wirtschaftswoche 28 / 6.7.1984

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EP 0 407 615 B2

Description

[0001] The present invention relates to a recording medium and, more particularly, to a heat transfer recording medium which is preferably used as an identification card, etc. and provides greater security against counterfeiting and falsifying.

[0002] Conventionally, many types of cards such as identification cards, driving licences and membership cards carry thereon various items of information to provide a disclosure of what the bearers are. Of the most importance for ID cards in particular are literal information such as name and address and a photographic image of face.

[0003] One classical technique for applying a photograph of face to each of various cards involves bonding it to a given region of the card with an adhesive. Problems with this technique are that it is very laborious; it makes the surface of the card uneven and so rids it of flatness; and it allows the card to be easily counterfeited or falsified by the replacement of another photograph of face.

[0004] In order to solve the defect of such an old technique as mentioned above, there has been developed a sublimation transfer type of imaging technique.

[0005] According to this heat transfer technique, a sublimation type of heat transfer sheet formed by providing onto the surface of a substrate film a layer containing a dye sublimable and transferable by heat is overlaid on a card substrate, and the assembly is heated from the back side of the sublimation transfer sheet with a thermal heat to reproduce a photograph of face on the card substrate simultaneously with printing of various letters, characters and so on. Alternatively, these characters may be printed in a hot meltable ink type of heat transfer manner. In either case, this technique has the advantage of being able to be carried out with a simple thermal printer. Since various items of information obtained by the above heat transfer technique are less than satisfactory in terms of such properties as rub resistance, however, the surface of the photograph, etc. is generally provided with a transparent surface protecting layer excelling in such properties as rub resistance.

[0006] EP-A-273 347 discloses a heat transfer recording medium which comprises a substrate, items of information thereon, an adhesive layer, and a transparent protective layer thereon, wherein the adhesive/protective layer(s) provide(s) security against counterfeiting.

[0007] Especially because the photograph is formed by fixing the dye in the card substrate, the card obtained by the above technique is of improved flatness and provides greater security against falsifying and counterfeiting. Even with this technique, however, there is not a little fear that the photograph and other information may be falsified or counterfeited by removing the protecting layer by solvents, acids, bases or the like.

[0008] It is accordingly an object of the present invention to provide a heat transfer recording medium best-suited for making ID cards, etc. to which greater security against counterfeiting and falsifying is imparted.

[0009] This object is attainable by the present invention set forth below.

[0010] More specifically, the present invention relates to a heat transfer recording medium in which a substrate carries on its surface some items of information such as an image and characters printed by a heat transfer technique and a trans-parent protective layer is provided on at least a part of the surface of the thus recorded information optionally through an adhesive layer whereby said protective layer and/or adhesive layer function(s) to provide security against counterfeiting characterized by the features disclosed in claims 1 to 3.

[0011] On or in the adhesive or protective layer of the card providing a coating to various items of information, there is formed a safe-from-counterfeiting layer comprising a design or other marking, which does not substantially conceal the above information, thereby making it difficult for forgers to reconstruct the design or other marking when they intend to falsify or counterfeit the photograph, etc. Thus, falsifying or counterfeiting, if attempted, can immediately be found out, making it difficult to falsify or counterfeit the card.

[0012] Figures 10, 13 and 15 are each a sectional view illustrating a preferred embodiment of the present invention, and

Figures 11 and 12 are each a plan view illustrating a preferred embodiment of the present invention.

[0013] The present invention will first be explained generally with reference to the preferred aspects.

[0014] The present invention relates to a card characterized in that some items of information such as a photograph of face and characters are carried on the surface of a card substrate and a transparent protective layer is formed on at least a part of the information, said protective layer being in the form of an uneven layer.

[0015] Rather positively making the protective layer of the card providing a coating to some items of information take on an uneven form renders it difficult for forgers to reconstruct such an uneven form when they intend to falsify or forge the photograph, etc. Thus, falsifying or forging, if attempted, can immediately be found out, making it difficult to falsify or forge the card.

[0016] As diagrammatically shown in the sectional view of Fig. 10, the card according to this aspect is characterized in that some items of information such as a photograph of face 2 and characters 3 are carried on the surface of a card substrate 1 and a transparent protective layer 4 is formed on at least a part of the information, said protective layer being in the form of an uneven layer.

[0017] Figure 11 is a diagrammatical illustration of the flat surface of one embodiment of the card according to this aspect, in which there is a difference in the surface gloss of the protective layer 4. For instance, the surface glossiness decreases in the order of a, b, c, d and e.

[0018] In another embodiment shown in Fig. 12, the protective layer 4, for instance, is notched along its profile.

5 [0019] In yet another embodiment shown in Fig. 13, three protective layers are laminated together in such a way that their total thickness varies in section. In the instant aspect, the protective layers 4, 4' and 4" may all be transparent and colored differently with one another.

10 [0020] As long as it is provided on its surface with a dye receiving layer dyeable with a sublimable dye, the card substrate used for the present invention may be formed of any known material. For instance, use may be made of films or sheets of various plastics such as polyolefin, polyvinyl chloride, polyethylene terephthalate, polystyrene, polymethacrylate and polycarbonate. Use may also be made of white, opaque films or foamed sheets obtained from such synthetic resins to which white pigments and fillers are added. Use may further be made of synthetic paper (based on polyolefin, polystyrene, etc.), fine paper, art or coated paper, cast coated paper, wall paper, lining paper, synthetic resin or emulsion-impregnated paper, synthetic rubber latex-impregnated paper, synthetic resin-incorporated paper, paper-board, cellulose fiber paper or the like.

15 [0021] Still further, laminates comprising any desired combination of the above substrate films may be used to this end.

20 [0022] Figure 10 is one preferable embodiment of the card substrate 1 according to the invention, which comprises a center core 7 formed of polyvinyl chloride containing a white pigment and transparent polyvinyl chloride layers 8 and 8' laminated on both sides of the core 7. At least the transparent polyvinyl chloride layer 8, defining an imaging surface, contains a suitable amount of a plasticizer to make better the fixability of a dye.

25 [0023] The quantity of the plasticizer incorporated is in a range of preferably 0.1 to 10 parts by weight, more preferably 3 to 5 parts by weight per 100 parts by weight of polyvinyl chloride forming the dye receiving layer 8. Too small a quantity of the plasticizer, on the one hand, makes its fixability with respect to the sublimable dye so insufficient that abnormal transfer can occur in which the dye layer of the heat transfer sheet is transferred as such during heat transfer. Too large an amount of the plasticizer, on the other hand, reduces and softens the dye receiving surface and causes the printed image to be blotted and so become unclear during storage.

30 [0024] Optionally, the above dye receiving layer 8 may contain any desired additives such as coloring pigments, white pigments, body pigments, fillers, UV absorbers, antistatics, thermal stabilizers and fluorescent brighteners.

[0025] The card substrate 1 may be pre-formed on its surface with the required magnetic recording layer 9 and, although not illustrated, an embossed or printed pattern, an optical or IC memory, a bar code and so on. Alternatively, it may be provided with them by heat transfer or other systems after the carrying of such information as the photograph of face.

35 [0026] The photograph 2 to be carried on the card substrate 1 may be formed with a known sublimation type of heat transfer sheet in conventional manners. Simultaneously with this, literal or other information 3 may be formed with a sublimation type of heat transfer sheet. However, it is preferred that the literal information 3 is formed with a hot melting ink type of heat transfer sheet enabling black letters and characters to be printed at high density. Although it is understood that the photographic information 2 and literal information 3 may be formed with separate heat transfer sheets, more advantageous in view of process efficiency is that both types of information are formed simultaneously with a composite heat transfer sheet including a sublimable dye layer together with a meltable ink layer.

40 [0027] The lamination of the protective layer 4 for improving the service life or durability of the recorded information, e.g., the photograph of face, may be achieved by coating and drying a transparent coating material, laminating a transparent film and using a protective layer/heat transfer sheet. The protective layer 4 may be provided over, or on a part of, the recorded information at a step separate from the step of recording each type of information. In a preferred embodiment of this aspect, however, use is made of a composite heat transfer sheet in which the substrate film is provided thereon with a sublimable dye layer of at least one color, a hot-meltable ink layer of at least one color and a protective layer in that order, thereby simultaneously forming a gradient image such as photograph of face and a landscape, a monotonous image such as characters and markings and the transparent protective layer with the same heat transfer sheet.

45 [0028] In order to improve further the safe-from-falsifying/counterfeiting-properties of such a card as mentioned above, the present invention is characterized in that the protective layer is rather positively formed into an uneven layer.

50 [0029] The protective layer may be in various desired forms inclusive of the above mentioned ones. In what follows, explanation will be made typically with reference to the forms already mentioned.

55 (1) Uneven Gloss

[0030] When the protective layer is formed with a thermal head in heat transfer fashion, the surface glossiness luster may be varied incrementally in any desired form, as illustrated Figure 11, by varying the energy to be applied at suitable

intervals or successively. Optionally, the surface glossiness may then be varied following various designs.

(2) Uneven Profile

5 [0031] When the protective layer is transferred with a thermal head, it may be notched along its profile, as illustrated in Figure 12 by way of example. Alternatively, for the same purpose it may be hot stamped with a mold having notches along its profile.

(3) Uneven Thickness

10 [0032] As illustrated in Figure 13, a plurality of protective layers varying in area are transferred separately to vary their total thickness. As already mentioned, the protective layers may all be transparent and colored differently with one another. To this end, transparent pigments and dyes may be used. Furthermore, fluorescent brighteners, ultraviolet absorbers, infrared absorbers, etc. are incorporated into each protective layer. Although the difference in colors cannot visually be observed, for instance, it may be clearly distinguishable under black light or with an infrared detector, etc.

15 [0033] The uneven protective layer according to the present invention should be formed by a heat transfer technique. By way of example, the protective layer showing such desired unevenness as mentioned above can easily be formed by using such a protective layer/heat transfer sheet combination as illustrated in Figure 15.

20 [0034] Comprising a substrate film 10, a release layer 11 provided on the surface of the film 10, if required, and a protective layer 4 and an adhesive layer 12 provided thereon, the protective layer/heat transfer sheet shown in Figure 15 is transferred onto the information carrier surface of the card, whereby such a card as shown in Fig. 10 is provided.

25 [0035] As described in the present invention, to rather positively make the protective layer of the card providing a coating to some items of information take on an uneven form renders it difficult for forgers to reconstruct such an uneven form when they intend to falsify or forge the photograph of face, etc. Thus, falsifying or forging, if attempted, can immediately be found out, making it difficult to falsify or forge the card.

[0036] The present invention will now be explained more illustratively with reference to the following examples, in which all parts and percentages (%) are by weight unless otherwise indicated.

Example C1

30 [0037] A white core for a card substrate was prepared from a composition consisting of 100 parts of a polyvinyl chloride (with a polymerization degree of 800) compound containing about 10% of additives such as a stabilizer and 15 parts of a white pigment (titanium oxide), said core being 0.2 mm in thickness and measuring 30 × 30 cm.

35 [0038] Prepared was then a transparent sheet (of 0.15 mm in thickness) consisting of 100 parts of the above-mentioned polyvinyl chloride compound containing 3 parts of a plasticizer and 1 part of a lubricant, which was in turn hot-pressed on each side of the white core to obtain the card substrate used according to this invention.

[0039] Inks of three colors, each having the following composition and containing a sublimable dye, were prepared.

Yellow Ink

40 [0040]

Disperse dye (Macrolex Yellow 6G -C.I. Disperse Yellow 201 by commercialized by Beyer Polyvinyl butyral resin (Eslec 8X-I commercialized by Sekisui Chemical Co., Ltd.) Methyl ethyl ketone/toluene (1:1 by weight).	5.5 parts 4.5 parts 89.0 parts
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Magenta Ink

50 [0041] The same as the above-mentioned yellow ink, except that a magenta disperse dye (C.I. Disperse Red 60) was used as the dye.

Cyan Ink

55 [0042] the same as the above-mentioned yellow ink, except that a cyan disperse dye (C.I. Solvent Blue 63) was used as the dye.

[0043] A 4.5-μm thick polyester film was provided, which had been formed on its back side with a heat-resistant slip layer (of 1 μm in thickness) and on its front side with an adhesion-improving layer (of 0.5 μm in thickness) formed of

a polyurethane type resin. By means of gravure coating, the above-mentioned ink compositions were then repeatedly coated and dried on the front side of that polyester film over a width of 15 cm in a coating amount of about 3 g/m² in the order of yellow, magenta and cyan, thereby obtaining a heat transfer sheet containing the sublimable dye layers of three colors.

5 [0044] The sublimation heat transfer sheet was then overlaid on the card substrate, and a thermal energy was applied to the assembly with a thermal head connected to electrical signals obtained by the color separation of a photograph of face to effect sublimation transfer in the order of cyan, magenta and yellow, thereby forming a full-colored photograph.
 [0045] By means of gravure coating, a release layer-forming ink having the following composition was coated and dried in an amount of 1 g/m² (on solid basis) on the front side of a polyester film similar to the above-mentioned one,
 10 thereby forming a release layer.

Release Layer-Forming Ink

[0046]

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Acrylic resin	20 parts
Methyl ethyl ketone	100 parts
Toluene	100 parts

20

[0047] By means of gravure coating, the following ink was then coated and dried on the front side of the release layer in an amount of about 3 g/m² to form a hot meltable ink layer, thereby obtaining a hot melting type of heat transfer sheet.

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Hot Meltable Ink

[0048]

30

Acrylic resin + cellulosic resin	20 parts
Carbon black	10 parts
Toluene	35 parts
Methyl ethyl ketone	35 parts

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[0049] The heat transfer sheet was overlaid on the blank space of the card on which the photographic image had been formed, thereby forming symbolic images such as numerals, characters and other literal images and a bar code.

[0050] A 4.5-μm thick polyester film was provided, which had been formed on its back side with a heat-resistant slip layer and on its front side with an adhesion-improving layer (of 0.1 μm in thickness) formed of a polyester type resin. By means of gravure coating, a protective layer-forming ink having the following composition was then coated and dried on the front side of that film in an amount of 4 g/m² (on solid basis), thereby forming a protective layer.

40

Protective Layer-Forming Ink

[0051]

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Acrylic resin (BR-83 commercialized by Mitsubishi Rayon Co., Ltd.)	20 parts
Polyethylene wax	1 part
Methyl ethyl ketone	50 parts
Toluene	50 parts

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[0052] Subsequently, an adhesive layer-forming ink having the following composition was further coated and dried on the protective layer in an amount of 1 g/m² (on solid basis) to form an adhesive layer, thereby obtaining a heat transfer sheet combined with the protective layer.

55

Adhesive Layer-Forming Ink

[0053]

5	Acrylic/vinyl chloride/vinyl acetate copolymer (HS-32G commercialized by Showa Ink Co., Ltd.) Methyl ethyl ketone Toluene	20 parts 100 parts 100 parts
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10 [0054] With the heat transfer sheet combined with the protective layer, the protective layer was then transferred onto the surface of the photograph by a heat transfer technique. In the instant example, however, a printing energy was decreased from a zone a to a zone e by a 10% decrement to obtain a card according to this invention. The protective layer of this card decreases decrementally in surface gloss from the zone a to the zone e. The protective layer was removed from the card to retouch the photograph and form another protective layer with lacquer. However, the fact of counterfeiting came out immediately.

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Example C2

20 [0055] In Example C1, the transfer of the protective layer was effected with a hot stamper including a mold notched around it, thereby obtaining such a card according to this invention as sketched in Fig. 12.

Example C3

25 [0056] In Example C1, the transfer of the protective layer was carried out three times, as depicted in Fig. 13, thereby obtaining a card according to this invention. The protective layer of this card appears to be uniform by the naked eye, but it is noticeably rough to the touch.

Example C4

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[0057] In Example C1, the transfer of the protective layer was conducted three times, as depicted in Fig. 13, thereby obtaining a card according to this invention. In the instant example, the third cycle of transfer was performed using the heat transfer sheet combined with the protective layer shown in Fig. 15, said protective further containing a fluorescent brightener. The protective layer of this card appears to be uniform by the naked eye. Under black light, however, only the protective layer part, shown at 4", gave out a bright glow.

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Example C5

40 [0058] After transferring the uniform protective layer in Example C1, a dotted pattern was transferred onto that layer, as shown in Fig. 15, using the heat transfer sheet combined with the protective layer shown in Fig. 15, in which a transparent colored layer was interposed between the protective layer and the release layer, thereby obtaining a card according to this invention.

[0059] The above-mentioned cards all made it so difficult to reconstruct their protective layers that they were difficult to falsify.

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Claims

1. A heat transfer recording medium in which a substrate carries on its surface some items of information such as an image and characters printed by a heat transfer technique and a transparent protective layer is provided on at least a part of the surface of the thus recorded information optionally through an adhesive layer whereby said protective layer and/or adhesive layer function(s) to provide security against counterfeiting **characterized in that** said protective layer is provided thereon or therein with a design which does not substantially conceal said recorded information and said protective layer is formed of an uneven layer comprising an uneven gloss in which a surface glossiness luster varies incrementally.

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2. A heat transfer recording medium in which a substrate carries on its surface some items of information such as an image and characters printed by a heat transfer technique and a transparent protective layer is provided on at

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least a part of the surface of the thus recorded information optionally through an adhesive layer whereby said protective layer and/or adhesive layer function(s) to provide security against counterfeiting **characterized in that** said protective layer is provided thereon or therein with a design which does not substantially conceal said recorded information and said protective layer is formed of an uneven layer comprising an uneven profile being notched along its profile.

5

3. A heat transfer recording medium in which a substrate carries on its surface some items of information such as an image and characters printed by a heat transfer technique and a transparent protective layer is provided on at least a part of the surface of the thus recorded information optionally through an adhesive layer whereby said protective layer and/or adhesive layer function(s) to provide security against counterfeiting **characterized in that** said protective layer is provided thereon or therein with a design which does not substantially conceal said recorded information and said protective layer is formed of an uneven layer comprising an uneven thickness in which a plurality of protective layers varying in area is formed to vary their total thickness in section, each protective layer having incorporated fluorescent brighteners, ultraviolet absorbers or infrared absorbers for being distinguishable under black light or with an infrared detector.

Patentansprüche

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1. Wärmeübertragungs-Aufzeichnungsmedium, bei dem ein Substrat auf seiner Oberfläche einige Informationselemente, wie ein Bild und Schriftzeichen, die durch eine Wärmeübertragungstechnik gedruckt wurden, trägt und eine transparente Schutzschicht, gegebenenfalls mittels einer Klebeschicht, auf wenigstens einem Teil der Oberfläche der derart aufgezeichneten Information vorgesehen ist, wobei die Schutzschicht und/oder die Klebeschicht wirkt bzw. wirken, um Sicherheit gegen Fälschung zu verleihen, **dadurch gekennzeichnet, daß** die Schutzschicht darauf oder darin mit einem Design versehen ist, welches die aufgezeichnete Information im wesentlichen nicht verdeckt und die Schutzschicht aus einer unebenen Schicht gebildet ist, umfassend einen ungleichmäßigen Glanz, in welchem ein Oberflächenglanzschimmer inkremental variiert.

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2. Wärmeübertragungs-Aufzeichnungsmedium, bei dem ein Substrat auf seiner Oberfläche einige Informationselemente, wie ein Bild und Schriftzeichen, die durch eine Wärmeübertragungstechnik gedruckt wurden, trägt und eine transparente Schutzschicht, gegebenenfalls mittels einer Klebeschicht, auf wenigstens einem Teil der Oberfläche der derart aufgezeichneten Information vorgesehen ist, wobei die Schutzschicht und/oder die Klebeschicht wirkt bzw. wirken, um Sicherheit gegen Fälschung zu verleihen, **dadurch gekennzeichnet, daß** die Schutzschicht darauf oder darin mit einem Design versehen ist, welches die aufgezeichnete Information im wesentlichen nicht verdeckt und die Schutzschicht aus einer unebenen Schicht gebildet ist, umfassend einen ungleichmäßigen Glanz, in welchem ein Oberflächenglanzschimmer inkremental variiert.

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3. Wärmeübertragungs-Aufzeichnungsmedium, bei dem ein Substrat auf seiner Oberfläche einige Informationselemente, wie ein Bild und Schriftzeichen, die durch eine Wärmeübertragungstechnik gedruckt wurden, trägt und eine transparente Schutzschicht, gegebenenfalls mittels einer Klebeschicht, auf wenigstens einem Teil der Oberfläche der derart aufgezeichneten Information vorgesehen ist, wobei die Schutzschicht und/oder die Klebeschicht wirkt bzw. wirken, um Sicherheit gegen Fälschung zu verleihen, **dadurch gekennzeichnet, daß** die Schutzschicht darauf oder darin mit einem Design versehen ist, welches die aufgezeichnete Information im wesentlichen nicht verdeckt und die Schutzschicht aus einer unebenen Schicht gebildet ist, umfassend ein ungleichmäßiges Profil, welches entlang seines Profils gekerbt ist.

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4. Wärmeübertragungs-Aufzeichnungsmedium, bei dem ein Substrat auf seiner Oberfläche einige Informationselemente, wie ein Bild und Schriftzeichen, die durch eine Wärmeübertragungstechnik gedruckt wurden, trägt und eine transparente Schutzschicht, gegebenenfalls mittels einer Klebeschicht, auf wenigstens einem Teil der Oberfläche der derart aufgezeichneten Information vorgesehen ist, wobei die Schutzschicht und/oder die Klebeschicht wirkt bzw. wirken, um Sicherheit gegen Fälschung zu verleihen, **dadurch gekennzeichnet, daß** die Schutzschicht darauf oder darin mit einem Design versehen ist, welches die aufgezeichnete Information im wesentlichen nicht verdeckt und die Schutzschicht aus einer unebenen Schicht gebildet ist, umfassend eine ungleichmäßige Dicke, in welcher eine Vielzahl in der Fläche variierender Schutzschichten gebildet ist, um ihre Gesamtdicke im Schnitt zu variieren, wobei jede Schutzschicht fluoreszierende optische Aufheller, UltraviolettabSORber oder Infrarotabsorber beinhaltet, um unter unsichtbarer Strahlung oder mit einem Infrarotdetektor unterscheidbar zu sein.

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Revendications

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1. Milieu d'enregistrement par transfert thermique où un substrat porte à sa surface quelques critères d'information tels qu'une image et des caractères imprimés par une technique de transfert thermique et on fournit une couche protectrice transparente sur au moins une partie de la surface de l'information ainsi enregistrée éventuellement par une couche adhésive et ainsi ladite couche protectrice et/ou la couche adhésive jouent le rôle d'apporter la sécurité contre la contrefaçon **caractérisé en ce que** ladite couche protectrice est munie sur elle ou à l'intérieur d'un motif qui ne gêne sensiblement pas ladite information enregistrée et ladite couche protectrice est formée

d'une couche irrégulière comprenant un brillant irrégulier où le brillant de surface varie par incrément.

2. Milieu d'enregistrement par transfert thermique où un substrat porte à sa surface quelques critères d'information tels qu'une image et des caractères imprimés par une technique de transfert thermique et on fournit une couche protectrice transparente sur au moins une partie de la surface de l'information ainsi enregistrée éventuellement par une couche adhésive et ainsi ladite couche protectrice et/ou la couche adhésive jouent le rôle d'apporter la sécurité contre la contrefaçon **caractérisé en ce que** ladite couche protectrice est munie sur elle ou à l'intérieur d'un motif qui ne gêne sensiblement pas ladite information enregistrée et ladite couche protectrice est formée d'une couche irrégulière comprenant un profil irrégulier qui est entaillé le long de son profil.
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3. Milieu d'enregistrement par transfert thermique où un substrat porte à sa surface quelques critères d'information tels qu'une image et des caractères imprimés par une technique de transfert thermique et on fournit une couche protectrice transparente sur au moins une partie de la surface de l'information ainsi enregistrée éventuellement par une couche adhésive et ainsi ladite couche protectrice et/ou la couche adhésive jouent le rôle d'apporter la sécurité contre la contrefaçon **caractérisé en ce que** ladite couche protectrice est munie sur elle ou à l'intérieur d'un motif qui ne gêne sensiblement pas ladite information enregistrée et ladite couche protectrice est formée d'une couche irrégulière comprenant une épaisseur irrégulière où est formée une pluralité de couches protectrices de surfaces différentes pour faire varier leur épaisseur totale en coupe, chaque couche protectrice incorporant des azurants fluorescents, des absorbeurs d'ultraviolets ou des absorbeurs d'infrarouges pour qu'elle soit discernable à la lumière noire ou avec un détecteur infrarouge.
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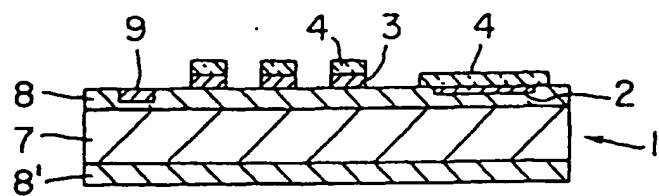


FIG. 10

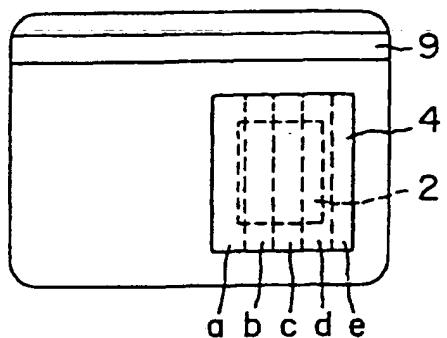


FIG. 11

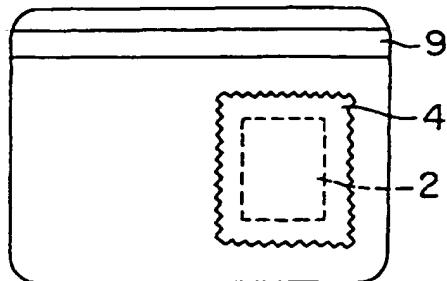


FIG. 12

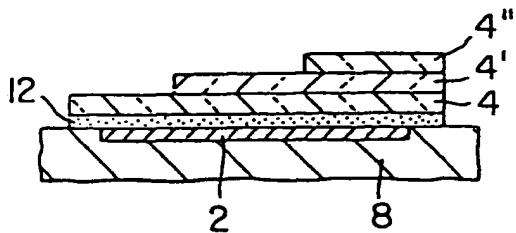


FIG. 13

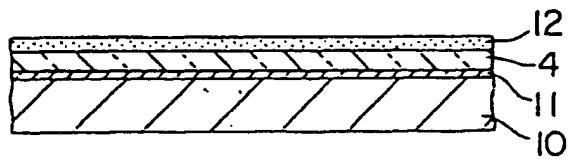


FIG. 15